

The Differential Diagnosis of Diplopia

By ISAAC A. DAVIDSON, B.A., M.D., D.P.H.,

Eye, Ear, Nose, and Throat Surgeon, Northern Ireland Command

Hon. Consultant Surgeon, Ulster Hospital for Children and Women, Belfast

Hon. Consultant Surgeon, Benn Ulster Eye, Ear, Nose, and Throat Hospital, Belfast

Hermia—"Methinks I see these things with parted eye,
When everything seems double."

Helena—"So, methinks,
"And I have found Demetrius like a jewel,
Mine own and not mine own."
—*A Midsummer-Night's Dream.*

IN Paris, on the 30th April, 1923, Professor Marquez, of the University of Madrid, delivered a lecture at l'Hotel-Dieu, presided over by Professor de Lapersonne, Professor of the Ophthalmological Clinic at the Faculty of Paris.

In that lecture Professor Marquez described a method devised by him for the elucidation of certain cases of diplopia.

In this paper I propose to explain his method in as simple a manner as possible, in what may seem to be a complicated subject.

The sudden onset of double vision in an adult is so distressing and alarming that the sufferer is compelled to seek professional advice at an early moment.

It is easy to give relief by the simple occlusion of one eye from vision.

To determine the reason of the double vision is not always easy, may be difficult, and indeed sometimes may leave an element of doubt in the mind of the physician.

Any method which pretends to facilitate the solution of our difficulties and resolve our doubts is of great interest, and, I think, is worthy of our consideration.

The method has its limitations. It only applies to affections of the extraocular muscles acting in the vertical plane, so we may dismiss from our minds such gross lesions as complete paralysis of the third and sixth cranial nerves, monocular diplopia, cases due to displacement of an eyeball by local effusions or tumour.

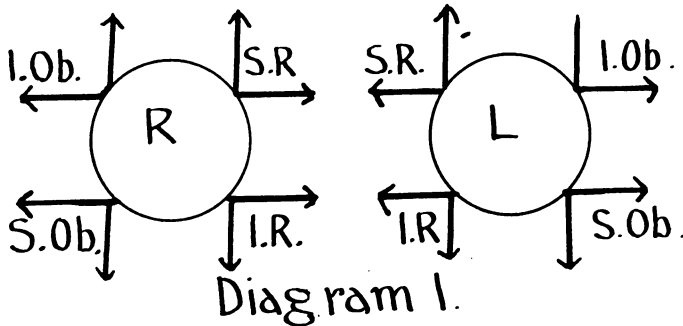
The muscles concerned are eight in number, and as each may be affected in one of two ways, by paresis or spasm, we may have to determine one out of sixteen possibilities, a formidable enough task.

To understand the working of the method, it is necessary to bear in mind certain definite principles.

1. In the normal eye, rays from an external object fall on the fovea. In a deviating eye these rays fall to one or other side of the fovea, according to the deviation, e.g., in convergent deviation on the nasal side of the fovea, in divergent deviation on the temporal side. The picture there formed is projected into space in the opposite direction, and is there seen by the patient.

2. Each muscle has a compound action, consisting of three components :—
 - (a) elevating or depressing the anterior pole of the eye.
 - (b) abducting or adducting.
 - (c) rotation of the eyeball clockwise or anticlockwise.

Diagram 1 shows the threefold action of each muscle.



Note that in diagram 1 the inferior oblique muscle is placed, not in its anatomical position, but in accordance with its function, which is to elevate the anterior pole of the eye. For a similar reason, the superior oblique is placed on the lower part of the diagram.

3. The significance of crossed or homonymous images.

Crossed images represent—

- (a) Paralysis of an adductor muscle.
- (b) Spasm of an abductor muscle.

Homonymous images represent—

- (a) Paralysis of an abductor muscle.
- (b) Spasm of an adductor muscle.

4. Recognition of the false image—

In the upper field of vision, the higher of the two images, and in the lower field, the lower of the images is the false one. The patient, wearing differently tinted glasses, can distinguish them by the colour.

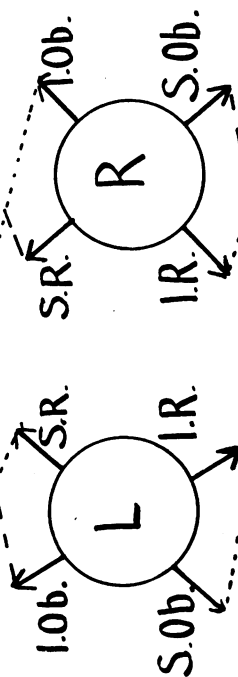
5. For practical purposes the patient is examined—

- (a) in the primary position, the eyes looking straight forward.
- (b) in each of the four diagonal directions, upwards to the right, upwards to the left, downwards to the right, downwards to the left.

In each of these diagonal directions two muscles act in association, one belonging to the right eye, and one to the left eye, the rectus of the direction in which the patient looks and the oblique of the other eye contrasting in name, e.g., if looking upwards and to the right, the associated muscles would be the superior rectus of the right eye and the oblique of the other eye of an opposite designation, in this case the left inferior oblique, or, if downwards, and to the left, then the muscles associated in this movement would be the left inferior rectus and the right superior oblique.

Up and to Left

Up and to Right



Down and to Left

Down and to Right

Diagram 2

Diagram 2 shows the associated movements in each of the four diagonal directions.

6. Rotation of the eyeballs.

Two directions, (a) clockwise, (b) anticlockwise. The muscles associated in the clockwise rotation are :—

The upper muscles (anatomically) of the right eye, and the lower muscles of the left eye, namely the superior rectus and superior oblique of the right eye, and the inferior rectus and inferior oblique of the left eye.

Those associated in anticlockwise direction are the lower muscles of the right eye and the upper muscles of the left eye, namely, the inferior rectus and inferior oblique of the right eye, and the superior rectus and superior oblique of the left eye, as shown in diagram 3.

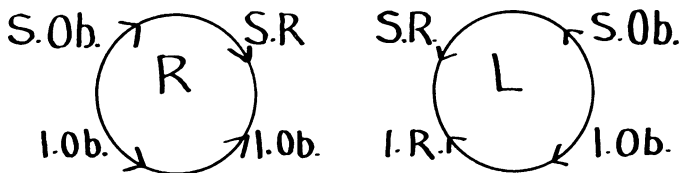


Diagram 3

EXAMINATION.

This takes place in a dark room, the patient being seated, and wearing differently tinted glasses, the red glass being in front of the right eye.

An assistant holds the head steady, eye movements only being allowed.

The examiner stands about two metres in front with a lighted candle.

Commence the examination in the primary position, eyes straight forward.

Enquire if two images are seen; if so, any difference in level, and which coloured image is to the right or left.

Note the replies.

Next examine by moving the candle in each of the four diagonal directions, the patient's head remaining steady, only his eyes following the candle.

Find out in which of these four directions the patient observes the greatest *vertical* separation of the images, which is the higher image, should this greatest separation be in the upper field of vision, and which is the lower image if in the lower field.

Note the replies.

Also enquire into the lateral relations of the two images, whether homonymous or crossed.

Note the reply.

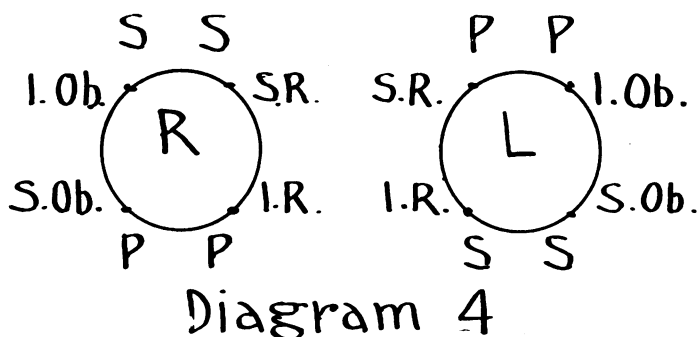
The information now acquired is sufficient to tell us which eye is involved and the particular muscle affected.

However, as a control test, we can examine the patient with the head on one or other shoulder, the candle being held in front. Enquire on which shoulder is the separation of the images greater.

Note the reply.

The examination is now over, and we can proceed to interpret the information at our disposal, and so apply it, by Marquez's method, to build up in a graphic manner the diagnostic picture.

For this purpose draw two circles to represent both eyes, and mark them R and L, place dots on the circumference of each circle to represent the situation of each muscle, as in diagram 4.



Take each item of information, make the correct deduction, and note the result on the diagram by placing the letter P or S, representing paralysis or spasm, opposite the muscles in their appropriate positions.

Let me give you an illustrative case in detail.

The following points have been elicited :—

1. In the primary position, the red image was lower than the other.
2. The greatest vertical separation of the images was observed on looking downwards and to the left, and that the lower image was the red one.
3. That the images were homonymous.
4. There was the greater separation with the head on the right shoulder.

INFERENCES TO BE DRAWN :—

1. Red image lower than the other.

This tells us that the anterior pole of the right eye is higher relatively than the anterior pole of the left eye.

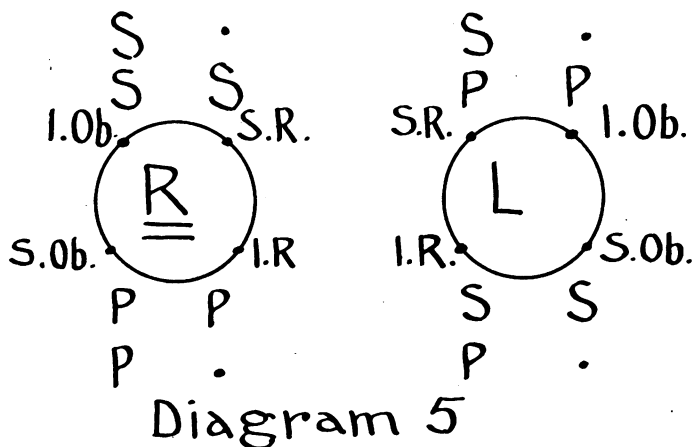
As yet we do not know which eye is in its natural position. Assume that the right eye is pathologically higher, this could be due to a spasm of an elevator or to a paralysis of a depressor muscle of the right eye.

It may be that the left eye is pathologically lower, in which case this, in a

similar way, could be due to a spasm of a depressor or a paralysis of an elevator muscle of the left eye.

Place the letters P and S in their appropriate positions in diagram 5, in accordance with the inferences we have made.

2. The greatest vertical separation on looking downwards and to the left, and the lower was the red image. The associated muscles looking in this diagonal



direction are the inferior rectus of the left eye and the superior oblique of the right eye.

The inference is that one of these two muscles is paralysed or that one of their antagonists, the left superior rectus or the right inferior oblique, is in a state of spasm.

Add the inference to the diagram by placing the letters P and S in their appropriate positions. This leaves a blank where the remaining muscles were not in action in looking downwards and to the left. A dot may be placed against these muscles to show that they were not concerned in the movement. Also we are told that the lower image was red, so we know that the muscle affected belongs to the right eye. We mark this on the diagram by underlining the letter R.

3. The images were homonymous.

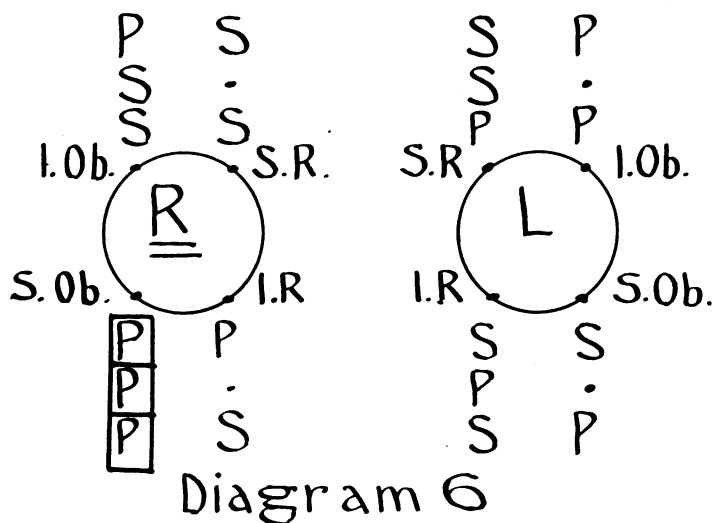
This signifies either paralysis of an abductor muscle or a spasm of an adductor muscle, and so we can mark this on the diagram by placing the letter P against each abductor muscle in both eyes, and the letter S against each adductor muscle. (Diagram 6).

We are now in a position to view the picture we have built up, and we can observe that there is only one muscle which shows the coincidence of an uninterrupted succession of letters of the same denomination, in this case the right

superior oblique, the letter P indicating that this muscle is in a state of paralysis, the underlining of the letter R in the circle bears this out.

Though we have formed an opinion, we have not exhausted the information at our disposal. We can use this as a control test.

In simple cases where only one muscle is at fault, this test should agree with the results of the previous ones. When more than one muscle is involved there may appear to be a contradiction, but the discrepancy is capable of explanation, as I shall show later



However, in this case, we are told that the images were further apart with the head resting on the right shoulder. In this position the eyes tend to assume the vertical position, that is they move in a clockwise direction. The inference to be drawn is that one of the muscles rotating clockwise is paralysed, or that there is a spasm of one of the muscles rotating anticlockwise.

So we can complete the picture by adding the letters P and S in their respective positions, P against each muscle associated in the clockwise rotation, and S against the others, taking care to remember that we are dealing now with the obliques in their anatomical position, that the superior oblique is an upper muscle.

We have added another stroke to the hammer which drives the nail home. We have now confirmation that the diagnosis already made is correct beyond doubt. You will have noticed that no reference has been made to the well-known fact that in cases of vertical diplopia the false image is inclined, whilst the true image is erect. The direction of the inclination is precise in each case, but Professor Marquez does not utilize this in his method. It could, however, be used as a

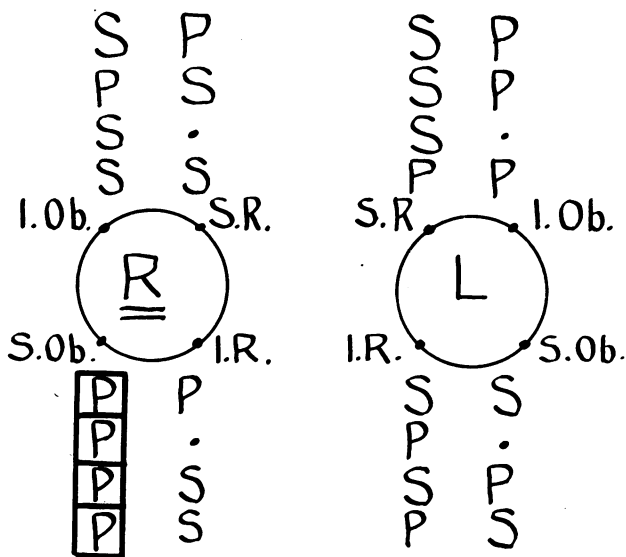


Diagram 7.

further confirmation. It presumes an intelligent patient, whose observations we can rely on.

Diagram 8, which I have copied from the *Encyclopedie Française d'Ophthalmologie*, shows in a very simple way the various inclinations of the false image, both in the upper and lower fields of vision, in paralysis as also in spasm. It will be noticed that in paralysis the upper end of the false image in the upper field, and the lower end of the false image in the lower field, is centrifugal in its relation to the erect image, whereas in spasm these are centripetal.

I have entered fully and at length into the description of this illustrative case, using separate diagrams and building up, step by step, the finished picture. This is for the sake of clearness. In practice only one diagram is required.

The second case will be dealt with in a few words.

Information elicited :—

1. Primary position—image of left eye lower.
2. The greatest vertical separation found on looking down and to the right; the lower image was red.
3. Images crossed.
4. Head on left shoulder showed greater separation.


Interpreting these findings on the principles already enunciated, the resulting picture (diagram 9) reveals a spasm of the left inferior oblique muscle, the control test confirming the diagnosis.

Finally, let me quote you a complicated case, taken from the practice of Professor Marquez—

History—The patient had had a “cold in the head” for five days, during which

1. That the red image was lower than the other.

P



S




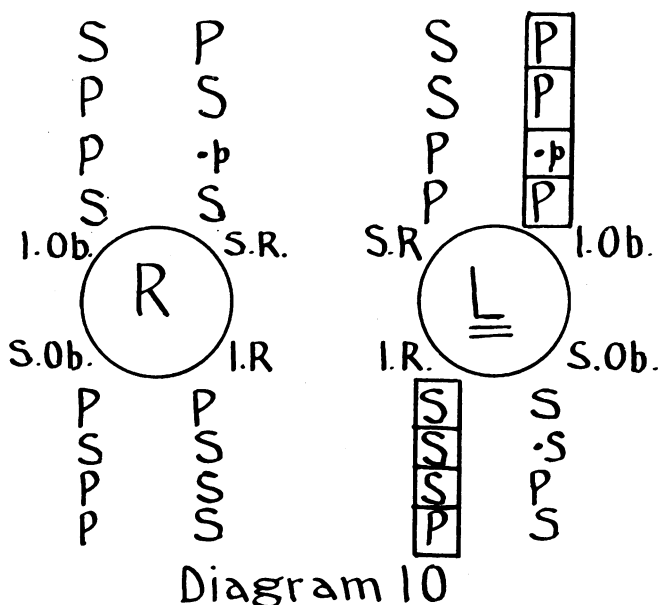
Diagram 8

2. That the greatest vertical separation of the images was on looking upwards and to the left. Also that on looking upwards and to the right the images were separated, but to a less degree.

Diagram 9

left inferior rectus, but when we use the control test we find a discrepancy. This led Professor Marquez to look for a further cause. Remembering that the patient had noticed some separation of the images on looking upwards and to the right, though not so well marked as on the left, and interpreting this in the usual way, and adding the results to the diagram, with small letters p and s, the new composite picture (diagram 10) showed, in addition to a spasm of the left inferior rectus, a paralysis of the left inferior oblique.

This explained to him the apparent discrepancy in the control test. In this test we are only considering the rotation components of the muscles. Both muscles belong to the same rotatory group (viz., the clockwise), being both lower muscles



of the left eye. The principal function of the oblique muscle is that of rotation. The rotary influence of an inferior rectus is very small, and although this is slightly increased by spasm, its effect was felt less than the complete absence of the naturally strong rotatory action of the oblique muscle, and so this factor preponderated, and reveals itself in the control test.

I have given a sufficient number of illustrative cases to enable the reader to understand the working of the method, and to allow him to form his own judgment as to its importance and utility.

Personally I have found it useful in practice. It is ingenious, logical, rapid in performance, and, I think, convincing.

I hope others will agree with me that it is worthy of being more widely known.

It is with that object, and in that spirit, that I make this contribution.